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UNITED STATES DEPARTMENT OF AGRICULTURE

Agricultural Research Service  
Horticultural Crops Research Branch  
Fruit and Nut Crops Section

Report of STRAWBERRY CONFERENCE, May 26-27, 1955

U. S. Plant Industry Station, Beltsville, Md.

The 1955 Small-Fruit Conference took the form of a 2-day strawberry meeting at Beltsville, Md., the first day devoted to breeding, production, and disease problems; the second day specifically to black-root, root nematodes, and plant certification. There were over 100 in the field the first day, 83 at dinner on the 26th, and about 100 in the auditorium the second day, with a total registration of 138.

First Day. Dr. F. P. Cullinan, Chief of the Horticultural Crops Research Branch, Agricultural Research Service, U. S. Department of Agriculture, welcomed the members of the Conference in the auditorium. Then the group went to the South Farm to the strawberry breeding and production plots. They saw the recently introduced Dixieland, Pocahontas, and Stelemaster as well as the principal commercial varieties. Selections of particular interest were: US-3939 (Midland x Tennessee Shipper and non-resistant to red stele), to be introduced, and Md-US-2101 and 2359, red-stele resistant (to 1 strain) selections being widely tested. US-3939 has a large berry, and fruits about 5 days earlier than Blakemore; Md-US-2101 has a firm, high-flavored, very smooth berry of second early season that keeps its brightness well. Md-US-2233 (resistant to 2 strains) and US-4194 (resistant to 1 strain) were also observed. Md-US-2233 seems worthwhile to supplement Stelemaster for areas where strains of red stele other than the common one are present. US-4194 has plant vigor and high dessert quality. About 240 selections under trial were seen.

For the first time plants of 16 varieties and 4 selections substantially virus- and nematode-free were being compared in replicated plantings. In another comparison, 8 advanced-test selections were being compared with 2 varieties. Runner thinning of 4 varieties for 4 dates of thinning and 3 varieties with 4 planting distances were compared. Several decaploids with the flavor of the Alpine venca and pentaploid seedlings (nearly sterile) of octoploids x diploids were seen. Very large fruit size of some NC-US and the Strawberry Institute (Calif.) selections were noted.

Adjacent to the strawberry planting was the tetraploid thornless seedling black-berry planting with thornlessness derived from Merton Thornless.

The propagation of virus-free foundation stocks in the 20'x200' screenhouse--51 plantings (2 plants each) of varieties in one half and 48 selections in the other half--were seen. Adjacent were plants for increase of varieties newly found free of virus and of promising selections. Also nearby were the plantings of cold storage plants (32° so far better than 28°); field fumigation equipment; and tests of fruit-rot control in Midland, Fairfax, and Redstar by sprays of Captan, ferbam, and Dowcide A. In another field, soil fumigation tests and plantings set with hot-water-treated plants were observed. In one test the treatment 118° for 20 minutes, 121° for 7 minutes, 124° for 3.5 minutes, 127° for 2 minutes, and 130° for 1 minute were compared with no treatment of nematode-infected plants and with no treatment of substantially nematode-free foundation stocks produced in the screenhouse. In other tests the interaction of date of digging, date of treating, methods of storage, periods of holding following removal from storage, and the use of TMTD in cooling dips on the subsequent growth of Blakemore strawberry plants are being investigated.



In the evening, Dr. Scott presided at a breeding and culture symposium. Dr. Klinkenberg gave a paper on "Strawberries in the Netherlands," prepared jointly with Miss Kronenberg. She pointed out that strawberries were the most important small fruit of the Netherlands; that selection of healthy stocks, certification, black-root-rot control, tests of new varieties, and breeding better preserving and better early and midseason varieties were important research objectives in their country.

Dr. Bringhurst, in charge of Small-Fruit-Production Research of the University of California, told of the organization and extent of the strawberry breeding program, work being under way in southern California, as well as at and near Davis. Shasta and Lassen, released in 1945 by the California Agricultural Experiment Station, are far the most important varieties. Objectives are varieties as productive as Shasta and Lassen with large size, higher quality, and improved firmness, shipping and freezing qualities, that are also virus-tolerant and verticillium-resistant, and have low chilling requirements.

Geo. F. Waldo (USDA), of Corvallis, Oreg., gave an illustrated talk on the strawberry breeding work in Oregon and briefly on that in Washington. Copies of his paper were distributed to those present. Dr. Geo. M. Darrow summarized the objectives, extent of the breeding work, and some of the important crosses of eastern experiment stations; copies of the summary were distributed. Prof. J. S. Bailey, of Massachusetts, gave a talk on cultural problems in New England. Among those mentioned were fertilizers, weed control with Chlora IPC and Crag #1, the control of cyclamen mite, red stele-root disease, development of virus-free stocks, use of screenhouses and soil fumigation to control black-root. He showed remarkable results following soil fumigation. Dr. Hitz, of Delaware, showed the progress of his work to limit late runner production after full stands were obtained using maleic hydrazide (MH) at 1,000 p.p.m. Dr. Denison, of Iowa, and Dr. Hemphill, of Missouri, commented briefly on their work on runner control with MH. Dr. Parker, of Virginia, commented on the control of winter weeds by spraying the mulch material with herbicides before applying the mulch on the strawberry beds.

Second Day. At 8:30, Prof. Burkhardt, of the University of Maryland, showed his hot-water-treating equipment for killing root nematodes in strawberries. It was designed to treat 9,000 plants per hour at 127° for 2 minutes. Dr. Goheen showed his laboratory heat-treating equipment (5-gal. crock with heating element and agitator) for up to 25-plant lots. Dr. Goheen and associates showed various experiments on hot-water treatments. These experiments demonstrated that plants dug in Maryland must be held in storage at 32° for 2 weeks prior to treatment or damage will result. Plants can be safely dug at any time from December 1 to March 15. Treatment should be made at or near the end of the storage period. They also showed nematode inoculation studies, indexing for virus, Goheen's test for graft union, hot-air chamber to inactivate virus in varieties of which no virus-free plants are known. Then screenhouse soil fumigation with methyl bromide was seen.

At 10:00 o'clock the nematode and black-root control discussions were started, Dr. Magness presiding. Dr. Steiner gave a talk on "Nematodes as we see them today," noting that nematodes far out-number insects. He pointed out that there are ecto- and endoparasitic nematodes and that some are indirectly injurious--they may carry fungi and other organisms that cause disease. He stated that small numbers can produce far-reaching effects, because many plant parasitic nematodes feed by perioral digestion; that is, the nematodes apparently inject secretions of their esophageal glands into tissues of the plant host inducing the production of assimilable food for the nematodes. Therefore, it appears that nematodes may produce far-reaching physiological disturbances in an attacked plant, disturbances that surpass any nutrient depletion they may cause. They obviously also break down protective enzyme systems that a plant may have for other disease agents, as shown in all disease complexes investigated where nematodes have a part. Dr. Klinkenberg gave a paper on her work in the Netherlands on black-root control by soil fumigation and her evidence that black-root is caused directly by the meadow nematode, Pratylenchus penetrans. This paper is to be published in the Plant Disease Reporter. Dr. Brooks, of Florida, then



discussed the sting nematode on strawberries in his State. This nematode cuts the roots to a mere brush about 2" long and produces spotted areas of weakened and dying plants in the fields. Because strawberries are an annual crop, occupying the ground from October to April, row fumigation has been very effective. Fifty to 60 percent of the entire strawberry acreage is soil-treated at a cost of \$10 to \$15 per acre. The fumigant may penetrate 12" below and 7" to each side of the point of application. Messrs. Goheen and Taylor (USDA) spoke briefly on the distribution of strawberry nematode species in the United States and discussed techniques for their study. They discussed the spread of nematodes through the wide distribution of nursery stocks. Mr. Taylor discussed the conditions for best results in soil fumigation. Dr. Braun, of New York, recognized red stele and verticillium wilt as important diseases of strawberries in his State. He is testing virus-free vs. ordinary stocks, in fumigated vs. non-fumigated soils, and nematode-free vs. ordinary stocks. Prof. Bailey, of Massachusetts, in cooperation with Dr. Goheen surveyed strawberries from 18 counties in the State. Twenty of 24 samples had nematodes. Kodachromes showed the remarkable effects of soil fumigation on plant stand and growth. Dr. Hutchinson, of New Jersey, reported that a survey of 63 fields in 1954 showed 30 fields apparently free of nematodes and only 2 fields with root-knot. In 1955 only about 4 fields of a similar number sampled appeared to be free of nematodes.

In the afternoon, Dr. Feichtmeir, of the Shell Company, Denver, Col., discussed the new nematocide "Nemagon," sold this year in the West but not east of the Rockies. Experiments are currently under way to test whether or not the nematocide may have a place in strawberry production. The material apparently can be used on growing plants at a rate of 1 or 2 gallons per acre. Dr. Porter, of Larvacide Products, New York City, discussed the use of chloropicrin on a field scale to control verticillium as well as nematodes. At 15 pounds per 1,000 square feet, its cost was about \$500 per acre. Experiments were in cooperation with the University of California. Dr. Gray, of the Dow Chemical Company, Washington, D. C., discussed the bromine compounds, especially W-85 and MC<sub>2</sub>. He called attention to the use of a fumigant to kill weed seed in straw and to the increase in plant stands (116 percent in one test) from the use of a soil fumigant. He also discussed MBr as a fumigant for cyclamin mite control.

In the session on inspection and certification problems, H. L. Bruer, Chief of the Tennessee Department of Agriculture Inspection Service, said their system had been in operation for 1 year and they had 99 acres of virus-free plants last year but expected far more, possibly 90 percent of all nursery plantings, this year. They have 2 types of certification--ordinary stocks and virus-free. Their virus-free foundation stocks must be in a screenhouse and isolated 3,000 feet from other strawberries. Much needs to be learned and they expect to change regulations as information develops. When plants are fall-dug, small blocks in low spots must be left until the following spring to test for red stele. No extra charge is made for inspection of virus-free stocks. Dr. Weaver, State Plant Pathologist for Maryland, told of their screenhouse at the University Farm at Salisbury for furnishing foundation stocks to plant growers. Several nurserymen have fumigated their fields for several years for nematode control. Dr. Bringham, of California, said that in his State only 3 varieties are certified--Shasta and Lassen for California, and Marshall for sale outside of the State. The State does the indexing, using bracteata (Fragaria vesca var. bracteata) as the indicator plant, the plant grower paying for the indexing. Samples of each 1,000 plants are indexed. Dr. Brooks, of Florida, said that Arkansas had a virus-free certification system in effect.



Attendance, Strawberry Conference, May 26-27, 1955  
Beltsville, Maryland

Adams, R. E., Morgantown, W. Va.	Maxwell, C. W., Fredricton, N. B., Canada
Allen, Lee, Salisbury, Md.	Menzies, J. A., Winnipeg, Canada
Apt, Walter, USDA, Puyallup, Wash.	Meyjee, Henry, Riverhead, L. I., N. Y.
Arcian, H. B., Blacksburg, Va.	Miller, P. M., New Haven, Conn.
Bahn, H. C., New Brunswick, N. J.	Morrow, E. B., Raleigh, N. C.
Bailey, J. S., East Wareham, Mass.	Moulton, J. E., South Haven, Mich.
Becker, Walter, Burlington, Vt.	Mullin, R. S., Norfolk, Va.
Bobb, A. C., Storrs, Conn.	Negley, F. B., Harrisburg, Pa.
Boehm, R. F., New Brunswick, N. J.	Neiman, Harry, Dover, Pa.
Boll, Herschel, Goshen, Ind.	Norcross, R. E., Wallingford, Conn.
Bolton, A. T., Ottawa, Canada	Nugent, T. J., Norfolk, Va.
Boston, A. W., Stillwater, Pa.	Oberle, G. D., Blacksburg, Va.
Boston, William, Stillwater, Pa.	Ozard, W. E., Albany, N. Y.
Boyd, W. M., Trenton, N. J.	Parker, M. M., Norfolk, Va.
Braun, A. J., Geneva, N. Y.	Phillips, E. L., Charlottesville, Va.
Bringham, R. S., Davis, Calif.	Porter, R. P., New York, N. Y.
Brittner, Carl, University Park, Pa.	Potter, H. S., Salisbury, Md.
Brooks, A. N., Lakeland, Fla.	Quisenberry, K. S., USDA, Washington, D. C.
Brown, J. F., Vineland, Ont., Canada	Race, S. R., New Brunswick, N. J.
Bruer, H. L., Nashville 3, Tenn.	Rayner, Jack, Salisbury, Md.
Bunting, Gene, Selbyville, Del.	Rawlings, Jack, Blacksburg, Va.
Bunting, Norman, Selbyville, Del.	Reed, J. P., New Brunswick, N. J.
Burkhardt, G. J., College Park, Md.	Rich, A. E., Durham, N. H.
Childs, W. H., Morgantown, W. Va.	Roeber, W. E., Jackson, Tenn.
Cooper, Mr., Vineland, Ont., Canada	Rueff, J. U., University Park, Pa.
Crittenden, H. W., Newark, Del.	Scott, David, New York, N. Y.
Crone, Paul, Dover, Pa.	Sinclair, D. G., Dayton, Tenn.
Denisen, E. L., Ames, Iowa	Sinclair, Paul, Dayton, Tenn.
Drieling, F. R., Blacksburg, Va.	Slate, Geo., Geneva, N. Y.
Elliott, John, Storrs, Conn.	Smith, Carter R., New Brunswick, N. J.
Feichtmeir, E. F., Denver, Col.	Steelman, C. H., Princeton, N. J.
Flagg, Charles, Dunkirk, N. Y.	Teske, A. H., Blacksburg, Va.
Fetrew, Walter, Dover, Pa.	Thompson, A. H., College Park, Md.
Fish, H. S., Amherst, Mass.	Thorne, G., Salt Lake City, Utah
Gilbert, Frank, Sturgeon Bay, Wisc.	Townshend, John, St. Catharines, Canada
Gray, H. E., Washington, D. C.	Valleau, W. D., Lexington, Ky.
Harrison, M. P., Fredericton, N.B., Canada	Vallejo, M., Chile, S. A.
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Haut, I. C., College Park, Md.	Vandemark, J. S., Lafayette, Ind.
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Hough, L. F., New Brunswick, N. J.	White, D. G., University Park, Pa.
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Hutchinson, J. D., Wilkes-Barre, Pa.	Wyld, R. G., Honeoye Falls, N. Y.
Ichisaka, Vernon, Bridgeton, N. J.	Wyld, Mrs. R. G., Honeoye Falls, N. Y.
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Jenkins, W. R., College Park, Md.	Zellar, Chas., Benton Harbor, Mich.
Jordan, T. D., Jamestown, N. Y.	Zucker, Mrs. J., Detroit, Mich.
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Judson, Victor, Bristol, Ind.	Buhrer, E.M. Gravatt, A.R. Scott, D.H.
Klinkenberg, Caroline, Wageningen, Holland	Cobb, G.S. Ink, D.P. Shafer, T.
Knierim, J. A., East Lansing, Mich.	Cullinan, F.P. Kech, E.J. Smith, F.F.
Kolbe, M. H., Morgantown, W. Va.	Darrow, G.M. Lusby, E.D. Smith, J.B.
Latimer, L. P., Durham, N. H.	Dunegan, J.C. Magness, J.R. Steiner, G.
Lefebvre, C. L., USDA, Washington, D. C.	Ellsworth, M. McGrew, J.R. Taylor, A.L.
Magill, W. W., Lexington, Ky.	Goheen, A.C. Martin, J.H. Worthington,
Marcus, C. P., Jr., Selbyville, Del.	Golden, A.M. Schindler, A.F. J.T.
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